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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/596,126	05/31/2006	Euijoon Yoon	20506/0204309-US0	2554
7278	7590	10/18/2007		
DARBY & DARBY P.C. P.O. BOX 770 Church Street Station New York, NY 10008-0770			EXAMINER CRAWFORD, LATANYA N	
			ART UNIT 2813	PAPER NUMBER
			MAIL DATE 10/18/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>		<b>Applicant(s)</b>	
	10/596,126		YOON ET AL.	
	<b>Examiner</b>		<b>Art Unit</b>	
	LaTanya Crawford		2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) 1-10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 May 2006 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some    c) ☒ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |  |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. <u>October 11, 2007</u> .                   |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application  |
| Paper No(s)/Mail Date <u>05/31/2006</u> .  | 6) <input type="checkbox"/> Other: _____.                          |

### DETAILED ACTION

1. This office action is in response to application no. 10/596126 filed on 05/31/2006.

#### ***Election/Restrictions***

2. During a telephone conversation with Kevin Beach on October 11, 2007 a provisional election was made without traverse to prosecute the invention of device, claims 11-23. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-10 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

#### ***Claim Objections***

3. The specification, where noted, and claims 11, 12, 14, 16-19 & 22 are objected to because of the following informalities:

- a. Page 3, lines 11-12; Page 4, lines 3 & 8; Page 17, line 18; Page 18, line 7; Claim 11 page 21, line 4 and 11:  $\text{Al}_x\text{Ga}_y\text{In}_{i-x-y}\text{N}$  ( $0 \leq x \leq 1$ ,  $0 < y \leq 1$ ,  $0 < x+y < 1$ )
- b. Claim 12 page 21, line 16:  $\text{In}_x\text{Ga}_{i-x}\text{N}$
- c. Claim 14 page 22, line 4:  $\text{In}_x\text{Ga}_{i-x}\text{N}$
- d. Page 4, line 4; Claim 16 page 22, line 11:  $\text{In}_x\text{Ga}_{i-x}\text{N}$
- e. Claim 17 page 22, line 15:  $\text{Al}_y\text{Ga}_{i-y}\text{N}$  ( $0 \leq y \leq 1$ )
- f. Page 5, line 4, 8, & 12; Claim 18 page 22, line 18:  $\text{Al}_y\text{Ga}_{i-y}\text{N}$  ( $0 \leq y \leq 1$ )
- g. Claim 19 page 23, line 1:  $\text{Al}_y\text{Ga}_{i-y}\text{N}$  ( $0 \leq y \leq 1$ )
- h. Claim 22 page 23, line 13:  $\text{Al}_x\text{Ga}_y\text{In}_{i-x-y}\text{N}$  ( $0 < x < 1$ ,  $0 < x+y < 1$ )

- i. Page 17, line 14:  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  ( $0 < x < 1$ ,  $0 < x+y < 1$ )
  - j. Page 3, 19-20; Page 4 line 12:  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}\text{N}$  ( $0 < x < 1$ ,  $0 < x+y < 1$ )
4. Subscript *i* is not defined or is labeled inconsistently throughout the specification. The subscript *i* is interpreted as **1**. Subscript  $\chi$  in regards to claim 22 and page 17 line 14 is not defined or is labeled inconsistently in the specification. The subscript  $\chi$  is interpreted as **x**. The **o** in ( $0 \leq y \leq 1$ ) with regards to claim 17 is interpreted as **0**. The subscript  $i-\chi y$  in claim 22 is interpreted as **1- $\chi$ -y**. Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. **Claims 11, 12, 14-23** are rejected under U.S.C. 35 as being unpatentable over **Wang (US Patent 6,455,870 B1)** in view of **Bour (US Patent 6,955,933 B2)**

Regarding claim 11, Wang et al. discloses a substrate **11**; at least one nitride layer, **buffer layer (AlN)-10**, grown on the substrate **11** and including a top layer of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}$  ( $0 \leq x \leq 1$ ,  $0 < y \leq 1$ ,  $0 < x+y < 1$ ) **20**; a quantum well layer **21** grown on the top layer  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}$  ( $0 < x < 1$ ,  $0 < y < 1$ ,  $0 < x+y < 1$ ); and an additional nitride semiconductor layer **22** on the quantum well layer **21** (**fig. 4; column 4, lines 26-38**) but fails to teach the additional nitride semiconductor layer having a band gap energy higher than that of the quantum well layer; wherein the quantum well layer comprises an In-rich

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region, a first compositional grading region with In content increasing between the top layer of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}$  ( $0 \leq x \leq 1$ ,  $0 < y \leq 1$ ,  $0 < x+y < 1$ ) and the In-rich region, and a second compositional grading region with In content decreasing between the In-rich region and the additional nitride semiconductor layer.

However, Bour et al. teaches the additional nitride semiconductor layer **42** having a band gap energy higher than that of the quantum well layer **40** (**column 4, lines 9-25**); wherein the quantum well layer **40** comprises an In-rich region, a first compositional grading region with In content increasing between the top layer of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}$  ( $0 \leq x \leq 1$ ,  $0 < y \leq 1$ ,  $0 < x+y < 1$ ) and the In-rich region **42**, and a second compositional grading region with In content decreasing between the In-rich region and the additional nitride semiconductor layer **38** (**column 5, lines 66-67; column 6, lines 1-10 & 15-20**).

7. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the light emitting device of Wang et al. with the additional nitride semiconductor layer having a band gap energy higher than that of the quantum well layer; wherein the quantum well layer comprises an In-rich region, a first compositional grading region with In content increasing between the top layer of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}$  ( $0 \leq x \leq 1$ ,  $0 < y \leq 1$ ,  $0 < x+y < 1$ ) and the In-rich region, and a second compositional grading region with In content decreasing between the In-rich region and the additional nitride semiconductor layer taught by Bour et al. since doing so would reduce the piezoelectric field in the active region.

**Regarding claim 12**, Wang et al. discloses the quantum well layer **21** is formed of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  and  $x$  in the In-rich region of the quantum layer is equal to or more than 0.6 (**column 4, lines 35-38**).

**Regarding claim 14**, Wang et al. discloses the quantum layer **21** is formed of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  and  $x$  in the In-rich region of the quantum layer **21** is within a range of 0.5 to 0.8 (**column 4, lines 35-38**).

**Regarding claim 15**, Wang et al. discloses wherein the thickness of the quantum well **21** is equal to or less than 2 nm (**column 4, lines 35-36**).

**Regarding claim 16**, Wang et al. discloses the quantum layer **21** is formed of  $\text{In}_x\text{Ga}_{1-x}\text{N}$  and  $x$  in the In-rich region of the quantum layer **21** is equal to or more than 0.2 (**column 4, lines 35-38**).

**Regarding claim 17**, Wang et al. discloses wherein the additional nitride semiconductor **22** is formed of  $\text{Al}_y\text{Ga}_{1-y}\text{N}$  ( $0 \leq y \leq 1$ ) (**column 4, line 37**).

**Regarding claim 18**, Bour et al. discloses at least one barrier layer of  $\text{Al}_y\text{Ga}_{1-y}\text{N}$  ( $0 \leq y \leq 1$ ) **42** adjacent to the quantum well layer and having a band gap energy higher than that of the additional nitride semiconductor layer (**fig. 3; column 4, lines 9-25**).

**Regarding claim 19**, Wang et al discloses at least one barrier layer **22** of  $\text{Al}_y\text{Ga}_{1-y}\text{N}$  ( $0 \leq y \leq 1$ ) has a thickness equal to or less than 5 nm (**column 4, line 37**).

**Regarding claim 20**, Wang et al. discloses wherein the quantum well layer **21**, **25**, **29**, & **33** and the at least barrier layer of  $\text{Al}_y\text{Ga}_{1-y}\text{N}$  ( $0 \leq y \leq 1$ ) **22**, **26**, **30**, & **34** are alternately laminated to form a multi-quantum well structure (**view fig. 4; column 30-38, 41-45, & 48-52**).

**Regarding claim 21**, Wang et al. discloses wherein the pairs of the quantum well **21, 25, 29, & 33** and at least barrier layer of  $\text{Al}_y\text{Ga}_{1-y}\text{N}$  ( $0 \leq y \leq 1$ ) **22, 26, 30, & 34** are equal to or less than 100 pairs(view **fig. 4; column 30-38, 41-45, & 48-52**).

**Regarding claim 22**, Bour et al. discloses the top layer of  $\text{Al}_x\text{Ga}_y\text{In}_{1-x-y}$  ( $0 < x < 1, 0 < y < 1, 0 < x+y < 1$ ) is GaN **46 (fig. 3, column lines 65-67)**.

**Regarding claim 23**, Wang et al. x in the In-rich region of the quantum well layer **21** is equal to or less than 0.7(**column 4, lines 35-37**).

8. **Claim 13** is rejected under U.S.C. 35 as being unpatentable over **Wang (US Patent 6,455,870 B1)** in view of **Bour (US Patent 6,955,933)** as applied to claim 11, and further in view of **Kwon, Effect of Growth Interruption on In-rich InGaN/GaN Single Quantum Well Structures, 20 October 2003, pp 2831-2833**

**Regarding claim 13**, Wang et al. as modified by Bour et al discloses all the claim limitations of claim 11 but fails to teach wherein the quantum well layer is grown using an In source and a nitrogen source, and the thickness of the quantum well is reduced by growth interruption which is performed by supplying the nitrogen source with the supply of the In source intercepted .

However, Kwon et al. discloses wherein the quantum well layer is grown using an In source and a nitrogen source, and the thickness of the quantum well is reduced by growth interruption which is performed by supplying the nitrogen source with the supply of the In source intercepted (**2 Experimental, lines 1-4; 3 Results and Discussion, lines 10-16**).

9. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the light emitting the device of Wang et al. with quantum well layer is grown using an In source and a nitrogen source, and the thickness of the quantum well is reduced by growth interruption which is performed by supplying the nitrogen source with the supply of the In source intercepted taught by Kwon et al. since doing so would improve the structural quality of InGaN/GaN.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references are cited for disclosing related limitations of the applicant's claimed and disclosed invention: **Kneissi et al. (US Pub no 2005/0224781 A1), Shimizu et al (US Pub no 2006/0243960 A1), Edmund et al., (US Patent 6,906,352 B2), Sugawara et al. (US 7,148,518 B2), Schetlina et al. (US Patent 5,670,798), Tadatoma et al. (US Patent 5,810,925), Krames et al. (US Patent 6,133,689), Ibbetson et al. (US Patent 6,515,313 B1).**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LaTanya Crawford whose telephone number is (571) 270-3208. The examiner can normally be reached on Monday-Friday 7:30 AM -5:00 PM EST.

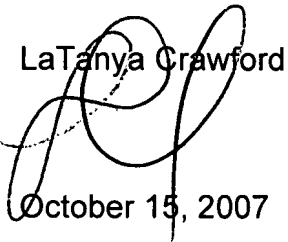
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.




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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LaTanya Crawford



October 15, 2007



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